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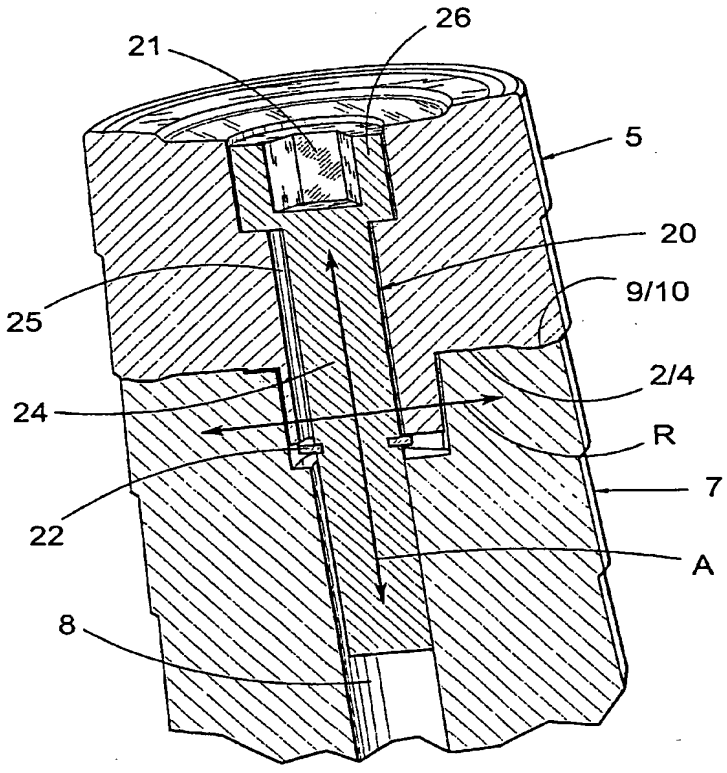
(54) Title: TOOL COUPLING FOR ROTATING TOOL



(57) Abstract: The present invention relates to a tool coupling for rotary tools, which tool coupling is intended to connect a first tool body (5) and a second tool body (7), whereby the tool coupling comprises a male part (1) arranged on the first tool body (5) and a female part (3) arranged on the second tool body (7), whereby the male part (1) and the female part (3) are intended to be in engagement with each other in the operative state of the tool coupling, and that the tool coupling comprises members (20) in order to apply an axial, uniting force to the male part (1) and the female part (3). Characteristic of the tool coupling according to the present invention is that it comprises members (9, 10) for mutual steering of the tool bodies (5, 7) in the radial direction, and that said members (9, 10) are situated at a radial distance from the male part (1) and the female part (3).

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TOOL COUPLING FOR ROTATING TOOLS

Technical Field of the Invention

The present invention relates to a tool coupling for rotary tools for chip removing machining, which tool coupling is intended to connect a first tool body and a second tool body, whereby the tool coupling comprises a male part arranged on the first tool body and a female part arranged on the second tool body, whereby the male part and the female part are intended to be in engagement with each other in the operative state of the tool coupling, and that the tool coupling comprises members in order to apply an axial, uniting force to the male part and the female part.

Background art

A tool coupling where a male part co-operates with a female part, whereby the same are conical and have non-circular cross-sections is previously known from SE-B-457 623. In the operative position of the tool coupling, the male part is received in the female part and at final displacement of the male part in relation to the female part, an elastic deformation of the female part takes place in the area of the open end thereof. Any additional steering in the radial direction of the tool coupling, apart from the mutual steering between the male part and the female part, is not found at the tool coupling according to SE-B-457 623.

A tool coupling which comprises a male part and a female part, which are conical with a cylindrical cross-sections is previously known from US-A-4 621 960. Furthermore, the tool coupling comprises driver members in the form of pins, which co-operate with recesses. An axially extending screw provides engagement between the male part and the female part, whereby contact is also established between stop faces included in the tool coupling, which are situated at a radial distance from the

male part/the female part. Said stop faces do not provide any steering in the radial direction of the tool coupling.

Aims and Features of the Invention

A primary aim of the present invention is to describe a tool coupling of the kind defined in the introduction, which coupling is free of play.

An additional aim of the present invention is that the coupling should be ensure a high precision, especially in the radial direction with regard to the chip removing machining which is carried out by the cutting inserts for chip removing machining applied on the tool head.

Yet another aim of the present invention is that the tool coupling according to the present invention should be user-friendly as well as automatically adjust the tool bodies which are connected together in mutually correct positions.

At least the primary aim of the present invention is attained by a tool coupling having the features defined in the subsequent independent claim 1. Preferred embodiments of the invention are defined in the dependent claims.

Brief Description of the Drawings

Below, two embodiments of the invention will be described, reference being made to the appended drawings, where:

Fig. 1 shows a perspective view of a male part included in the tool coupling according to the present invention, which is arranged on a first tool body;

Fig. 2 shows a perspective view of a female part included in the tool coupling according to the present invention, which is arranged on a second tool body and intended to be in engagement with the male part according to Fig 1;

Fig. 3 shows an axial cross-section through the centre of the first tool body according to Fig 1;

Fig. 4 shows in some perspective the two tool bodies in an assembled state, whereby the same are cut axially through the centre of the tool bodies; and

Fig. 5 shows a section, perpendicularly to the axial direction of the tool bodies, through the male part and the female part when the same are in engagement with each other.

Detailed Description of a Preferred Embodiment of the Invention

The embodiment of a tool coupling according to the present invention illustrated in Figs 1 and 2 comprises a male part 1, see Fig 1, and a female part 3, see Fig 2. The male part 1 is arranged on a first contact surface 2 of a first tool body 5 and the female part 3 is formed in a second contact surface 4 of a second tool body 7. The first tool body 5 may, for instance, consist of a cutter head while the second tool body 7 may, for instance, consist of an extender or the like. At the end turned from the female part 3, the second tool body 7 may be provided with some other type of tool coupling, for instance the tool coupling COROMANT CAPTO® marketed by AB Sandvik Coromant. The tool bodies 5 and 7 are only schematically illustrated in the present patent application.

In the embodiment illustrated, an axial first centre hole 6 extends through the first tool body 5 and an axial second centre hole 8 extends through at least a part of the second tool body 7. The first centre hole 6 is provided with a step while the second centre hole 8 is internally threaded.

Furthermore, the tool coupling according to the present invention comprises a steering which in the embodiment according to Figs 1 and 2 comprises a circular ridge 9, which is arranged on the first contact surface 2 at a certain radial distance from the male part 1, in connection with the circumference of the first tool body 5. Furthermore, the steering comprises a circular groove 10,

which is arranged in the second contact surface 4 at a certain radial distance from the female part 3, in connection with the circumference of the second tool body 7. How the circular ridge 9 co-operates with the circular groove 10 will be clear from the description below.

The male part 1 shown in Fig 1 is of a generally triangular with rounded corner portions 12 and 13, whereby the corner portion 12 situated farthest out is convex both in the direction of circumference of the male part and also in the axial direction of the male part 1. Between the corner portions 12, 13, the male part has two partial side surfaces 14 and 15, the first partial side surface 14 of which is plane while the second partial side surface 15 is convex in the direction of circumference of the male part 1. This is seen more clearly in the cross-section that is shown in Fig 5.

The female part 3, see Fig 2, has also a generally triangular shape with rounded corners, whereby said corner comprises two part portions 16 and 17. The first corner portion 16 has a bottom which is situated closer to the circumference of the second tool body 7 than the bottom of the second corner portion 17. Between the bottoms of the corner portions 16 and 17, a transition portion 18 is arranged, which has an extension in the axial direction of the second tool body 7. Between the respective corner portions 16/17, a side surface 19 extends, which preferably is plane.

The male part shown in Fig 1 fits into the female part 3 shown in Fig 2 thanks to a slight play between the male part 1 and the female part 3. The means that the male part 1 is not actively steered in the radial direction when the same is received in the female part 3 but the radial steering only takes place through the circular ridge 9 co-operating with the circular groove in a way that will be described more in detail below.

In Fig 4, the two tool bodies 5 and 7 are shown in connected position, i.e. the male part 1 is received in the

female part 3, whereby the contact surfaces 2 and 4 abut against each other and the circular ridge 9 is received in the circular groove 10. A double arrow A symbolizes the axial direction of the tool while a double arrow R symbolizes the radial direction of the tool. An externally threaded locking screw 20 extending axially is received in the first hole 6 and extends into the second hole 8. The locking screw 20 is in the usual way provided with an internal key recess 21 in order to enable rotation of the locking screw 20, and thereby connection of the tool bodies 5 and 7 in a satisfactory way. The locking screw 20 is also provided with a clamp ring 22 which is received in a radial groove in the locking screw 20. The function of said clamp ring 22 will be described below.

Thus, when connecting the two tool bodies 5 and 7 the male part 1 is inserted into the female part 3, whereby during the initial stage the corner portions 12, 13 of the male part bear against the first corner portions 16 and 17 of the female part 3. The displacement of the male part 1 into the female part 3 is effected by rotation of the locking screw 20, whereby the external threaded portion thereof is in engagement with the internally threaded hole 8. When the male part 1 has bottomed in the female part 3, the partial side surfaces 14 and 15 of the male part 1 are exactly opposite the side surface 19 of the female part 3. At this stage, also the contact surfaces 2 and 4 have come to abutment against each other, whereby the ridge 9 of the first tool body 5 is received in the groove 10 of the second tool body 7. By co-operation between the ridge 9 and the groove 10, a mutual steering in the radial direction of the two tool bodies 5 and 7 will be effected. By virtue of the play between the male part 1 and the female part 3, which is brought about by a certain play between the partial side surfaces 14, 15 and the side surface 19, see Fig 5, the steering which is achieved by the ridge 9 and the groove 10 will prevail over the steering which is achieved by the corner portions 13, 14, 16, 17 and the

partial side surfaces 14, 15 and the side surface 19, respectively. Preferably, in the section illustrated in Fig 4, the ridge 9 has a somewhat smaller curvature radius than the groove 10. As a consequence the requirements regarding precision of the ridge 9 and the groove 10 in practical manufacture is somewhat reduced.

In this connection, it should be pointed out that when a lateral force is applied to the first tool body 5, a mutual lateral displacement of the tool bodies 5, 7 will to an exceptionally high extent be counteracted by co-operation between the ridge 9 and the groove 10 thanks to the same being kept axially together by the locking screw 20.

When a rotation is applied to the second tool body 7, the female part 3 will naturally also rotate, whereby the male part 1 and the first tool body 5 are driven along. In this connection reference is made to Fig 5, which shows a section through the male part 1 and the female part 3 in the operative position of the same parts. As is seen in Fig 5, where the direction of rotation is marked with R, on rotation of the female part 3, the side surface 19 will contact the convex part side surface 15, whereby the rotational force is transferred via said three contact areas 15/19.

In Fig 5 is also seen most clearly that the locking screw 20 is provided with a longitudinal chamfer 23, which preferably extends along the entire shank 24 of the locking screw 20. Said chamfer 23 provides a space 25 between the shank of the locking screw 20 and the holes 6 and 8, whereby cooling medium may be supplied into said space. How the cooling medium is distributed further in the area of the head 26 of the locking screw 20 is not illustrated in Fig 4. In this connection, it should be pointed out that the design of the locking screw 20, i.e. the arrangement of a longitudinal chamfer 23 may have a general application for tools for chip removing machining where it is important to provide a space for supply of cooling medium.

When the first tool body 5 is to be dismounted from the second tool body 7, the locking screw 20 is rotated in the opposite direction in comparison with when the tool bodies 5, 7 are connected. Then, the clamp ring 22, which projects a distance outside of the circumference of the shank 24, will come into abutment against the first tool body 5 and pulls the same with it, whereby the male part 1 is removed from the female part 3.

In the above-described embodiment of the present invention, the tool bodies 5 and 7 are schematically illustrated in the form of generally cylindrical elements. However, the fact is that in reality the same said tool bodies 5 and 7 are machined depending on which type of tool which they are included in. Then, the periphery of said tool bodies 5 and 7 will normally be interrupted here and there, which in turn means that the circular ridge 9 and the circular groove 10 on the completed tool will not be continuous but interrupted here and there. For that reason, in the subsequent claims the phrase "arc-shaped" has been used instead of "circular".

Feasible Modifications of the Invention

In the above-described embodiments, the male part 1 is arranged on the first tool body 5, i.e. the part which, for instance, may constitute a cutter head. However, within the scope of the present invention it is also feasible that the female part 3 is formed in the first tool body 5, whereby in such a case the male part 1 is arranged on the second tool body, which for instance may constitute an extender.

In the above-described embodiment, the ridge 9 and the groove 10 are circular, whereby they for reasons that have been given above may be interrupted here and there. However, the ridges/the grooves do not need to be arc-shaped but they may have another curved shape or even be straight.

List of Reference Designations

1	Male part
2	First contact surface
3	Female part
4	Second contact surface
5	First tool body
6	First centre hole
7	Second tool body
8	Second centre hole
9	Circular ridge
10	Circular groove
12	Outer corner portion
13	Inner corner portion
14	First partial side surface
15	Second partial side surface
16, 17	Part portions of corner
18	Transition portion
19	Side surface
20	Locking screw
21	Internal key recess
22	Clamp ring
23	Chamfer
24	Shank
25	Space
26	Head

Claims

1. Tool coupling for rotary tool for chip removing machining, which tool coupling is intended to connect a first tool body (5) and a second tool body (7), whereby the tool coupling comprises a male part (1) arranged on the first tool body (5) and a female part (3) arranged on the second tool body (7), whereby the male part (1) and the female part (3) are intended to be in engagement with each other in the operative state of the tool coupling, that the tool coupling comprises members (20) in order to apply an axial, uniting force to the male part (1) and the female part (3), and that the tool coupling comprises members (9, 10) for mutual steering of the tool bodies (5, 7) in the radial direction, c h a r a c t e r i z e d in that the steering members comprise a ridge (9) on one of the tool bodies (5) and a groove (10) on the second tool body (7), and that the ridge (9) is received in the groove (10) in the operative state of the tool coupling, and that the ridge (9) is arranged adjacent to the periphery of the one of the tool bodies (5), and that the groove (10) is arranged adjacent to the periphery of the second tool body (7).

2. Tool coupling according to claim 1, c h a r a c t e r i z e d in that the ridge (9) and the groove (10) are arc-shaped.

3. Tool coupling according to claim 1 or 2, c h a r a c t e r i z e d in that the ridge (9) is arranged on a contact surface (2) of one of the tool bodies (5), and that the groove (10) is arranged in a contact surface (4) of the second tool body (7).

4. Tool coupling according to any one of the preceding claims, c h a r a c t e r i z e d in that in cross-section,

the ridge (9) has a somewhat smaller bending radius than the groove (10).

5. Tool coupling according to any one of the preceding claims, c h a r a c t e r i z e d in that the male part (1) and the female part (3) have a generally triangular cross-section.

6. Tool coupling according to claim 5, c h a r a c t e r-i z e d in that the male part (1) has at least one partial side surface (15) which is concave in the direction of circumference of the male part (1).

7. Tool coupling according to any one of the preceding claims, c h a r a c t e r i z e d in that the member for axially uniting the tool bodies (5, 7) consists of a locking screw (20), which has a longitudinal chamfering (23) on the shank part (24) thereof.

8. Tool coupling according to any one of the preceding claims, c h a r a c t e r i z e d in that the member for axially uniting the tool bodies (5, 7) consists of a locking screw (20), which has a radially groove, in which a clamp ring (22) is received which ring projects a distance outside the circumference of the shank (24) of the locking screw (20).

Fig. 1

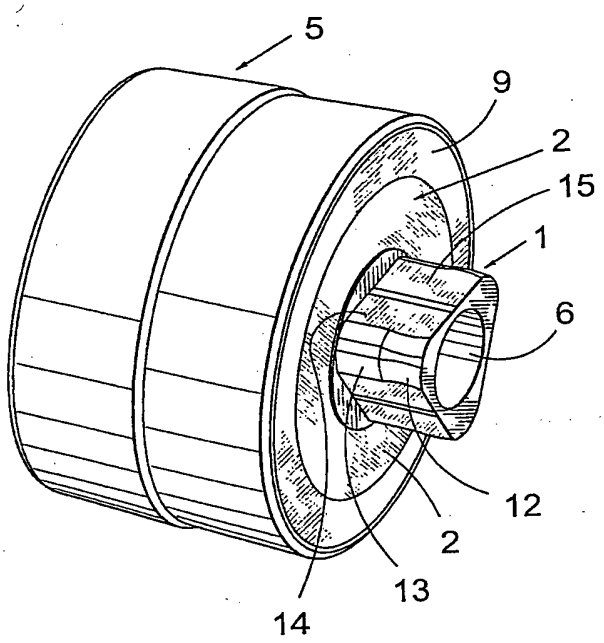


Fig. 2

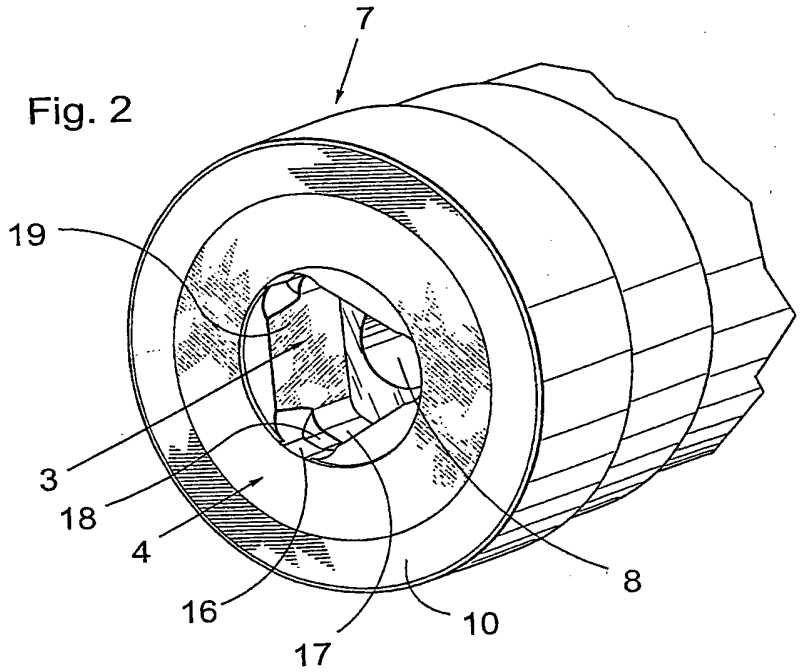


Fig. 3

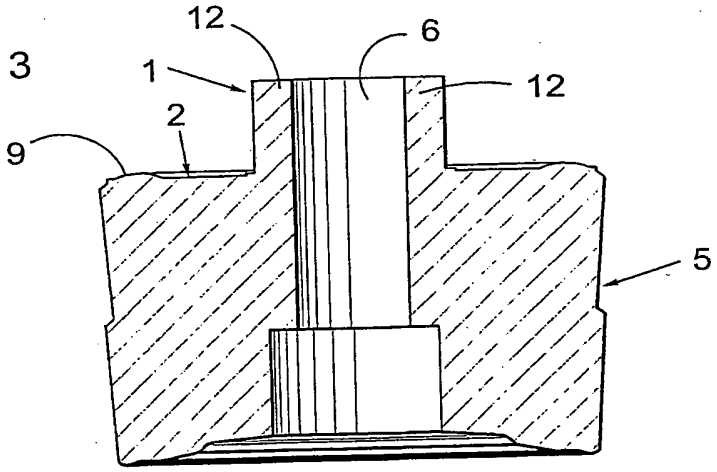


Fig. 4

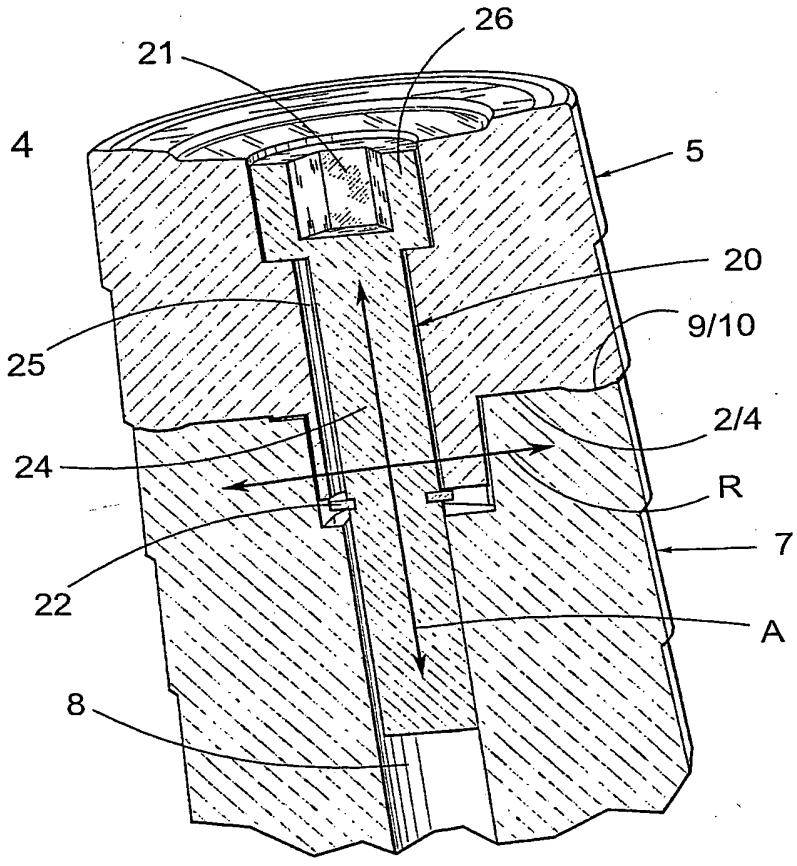
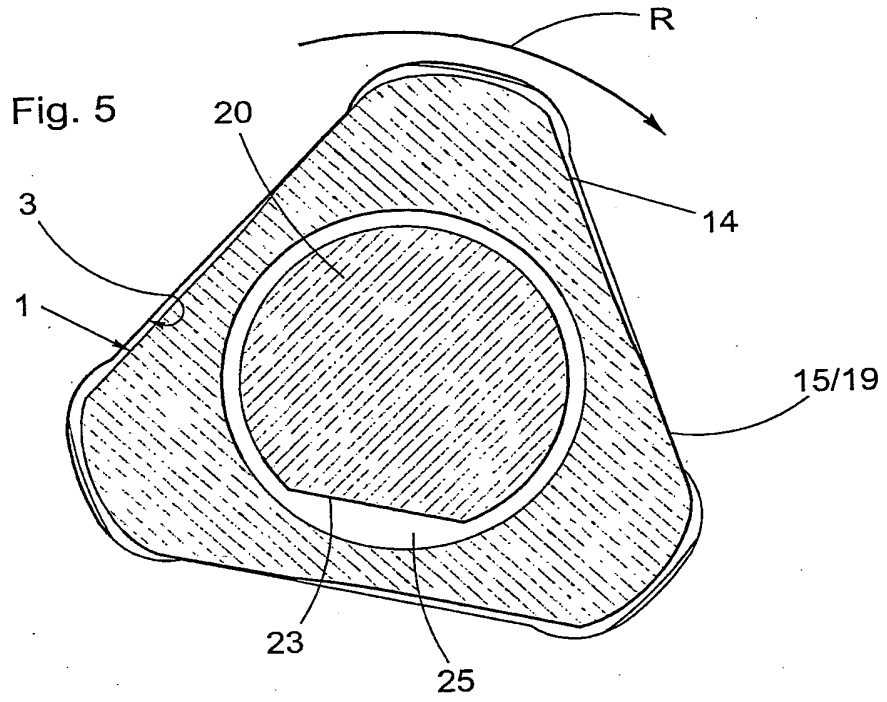


Fig. 5



INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B23B 51/00 // B23B 29/12, B23C 5/26
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B23B, B23C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 6276879 B1 (GIL HECHT), 21 August 2001 (21.08.01), figures 3,4, abstract --	1-8
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A	US 6059492 A (GIL HECHT), 9 May 2000 (09.05.00), figures 3,4, abstract --	1-8

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
24 April 2003	29-04-2003
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Fredrik Strand/Els Telephone No. +46 8 782 25 00

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

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